A STUDY OF PROGRAMED INSTRUCTION IN AN INTRODUCTORY PSYCHOLOGY CLASS[1]

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No one has a better chance to observe the confusion and conflicting results in the field of programed instruction than an editor of an educational journal. This is particularly true of the question of the relative efficacy of such instruction when compared with other means of presentation (Pressey, 1964). This report presents the results of an experiment involving programed learning in a typical college classroom, designed to study the relationship between content dimensions (both relevant and irrelevant) and method of presentation (teaching machine and programed textbook). The objectives of the research were two-fold: (a) To develop a procedure for the use of automated instructional devices and programed learning to supplement the methods traditionally used in the teaching of an introductory psychology course for prospective public school teachers; and, (b) To evaluate the learning outcomes resulting from the use of programed text material which is highly relevant and a highly relevant program presented by a Skinner-type teaching machine, as opposed to learning outcomes resulting from the use of programed text material which is only slightly relevant and a slightly relevant program presented by a Skinner-type teaching machine.

PROCEDURE

Subjects. Subjects for the study consisted of male and female undergraduates at Northwestern University who were enrolled in a two-quarter course in introductory psychology for education majors. The course was taught and administered jointly by the School of Education and the Department of Psychology. Out of an original enrollment of 130 students, 114 subjects remained in the course throughout the two quarters and constituted the total sample for the research.

Treatments. At the beginning of the Fall Quarter 1963, the students were divided equally and randomly into five groups. Each group was further randomly assigned to an experimental treatment or to a control condition for the duration of the experiment. Four of these groups were exposed for the two quarters to different experimental treatments involving the use of highly relevant and slightly relevant materials presented through the use of a teaching machine and a programed textbook. The fifth group was given only the traditional lecture and textbook materials.

The control group received the regular lectures plus assignments in E. R. Hilgard's *Introduction to Psychology*, 3rd ed. (1962), and further assigned readings from *The Scientific American*.

The two experimental groups subjected to the "highly relevant" condition were required in addition to the above to go through the programed workbook or *Student Guide* prepared by Teevan and Jandron (1962) for use with Hilgard's text. It consists of 1,350 frames of the constructed response type with no branching. One group used it as a programed text. For the other group, the 1,350 frames were adapted for automation by being put on a continuous tape for use in the Rheem Califone Didak 501 machine.

The "slightly relevant" conditions utilized the programed text by James G. Holland and B. F. Skinner, *The Analysis of Behavior* (1961). This is a text consisting of 2,000 frames which presents a Skinnerian point-of-view in introductory psychology. For one group it was used in its original form as a programed text, for the other it was put on a tape for use in the Didak machine.

The regular lectures and discussions were given to the entire class during the scheduled class meetings. Those students having assignments in programed text or on teaching machines executed them in addition to the regular class hours. These experimental groups were allowed to set their own pace with the programed materials.

In summary, the randomly constituted groups received the following treatments:

Group A: Holland and Skinner programed text in addition to regular lectures, the Hilgard textbook, and assigned readings.

Group B: Holland and Skinner programed text materials presented through a Rheem Califone Didak 501 Machine in addition to regular lectures, the Hilgard textbook, and assigned readings.

[1]This project was done under the sponsorship of Title VII of the National Defense Education Act (Project No. 1075).

Group C: The Teevan and Jandron programed workbook for the Hilgard text in addition to the Hilgard text, regular lectures, and assigned reading.

Group D: The Teevan and Jandron programed materials for the Hilgard text presented through a Rheem Califone Didak 501 Machine in addition to regular lectures, the Hilgard text, and assigned readings.

Group E: Regular lectures and the Hilgard text plus assigned readings.

Criteria for Performance Change. At the beginning of the Fall Quarter, before the start of class lectures, the total class was given a test of psychological knowledge consisting of random items picked from the multiple-choice items available for the Hilgard text, *Introduction to Psychology* (1962). These items were obtained from an item pool available to accompany the Hilgard text. Each chapter of the text is represented by twenty multiple-choice items. From this item pool, a balanced number of items were randomly picked from each chapter so that a random item test of 230 multiple-choice items was assembled. This pretest was administered on two successive days with 115 items presented to the total class on the first day and 115 items on the second day. In addition, during the Fall Quarter, two 50 item examinations and one 100 item examination consisting of multiple-choice items chosen from the same Hilgard item pool, but avoiding the items used in the pretest, were administered. These were given at appropriate intervals so that each test covered approximately one-third of the course and did not include material previously tested. The last of these three tests, the 100 item examination, was given during the final examination period for the Fall Quarter.

Except for the pretest the same testing procedure was followed during the Winter Quarter, with three multiple-choice tests being administered, consisting of the same number of items as during the Fall Quarter, covering approximately one-third of the course at each testing. The lectures and Hilgard textbook assignments were arranged so that approximately the first half of the Hilgard text was covered during the Fall Quarter and the last half during the Winter Quarter.

At the end of the Winter Quarter during the last week of class, and following the final 100 item test, the pretest consisting of 230 randomly selected Hilgard items was again administered in a two-day sequence with 115 items being given the first day and 115 the second. This posttest was identical to the pretest given at the beginning of the course.

Instructions Given to the Groups. At the beginning of the Fall Quarter the instructors explained to the students that, in addition to the instruction they would receive in the course, they would be involved in a research project which would allow them to gain some insight into experimental procedures in general and the process of experimentation in learning. They were told that they would be divided into various groupings, but that the groupings would have no influence on the grade they would receive in the course. They were also told that some groups would be given various tasks to complete and that their selection for a particular group was based on chance and not on any abilities they might or might not possess. The point that group assignment would not influence their grade was stressed throughout the course. The instructions were such that the investigators felt that the students were motivated to participate and respond. At the same time the instructions were not so detailed as to appraise the students of the specific purposes of the experiment.

Each of the four experimental groups (A, B, C, D) was given additional detailed instructions concerning the use of the teaching machines and the programed texts. A capable student assistant was in charge of scheduling the use of the machines. He was present and available during both quarters at specific times during the week in an automated instruction laboratory in the basement of a campus building easily accessible to the students. The students in the teaching machine groups (B and D) were allowed to set their own pace in scheduling appointments, but they were expected to complete an assigned number of units of each program during one quarter. The students in groups A and C were issued copies of the appropriate programed text material and were encouraged to use them and to respond to the items by writing in the books.

At the beginning of the Fall Quarter the five groups consisted of approximately 27 students each. However, normal attrition was such that the analysis of results was based on the following number of subjects in each group: Group A - 22, Group B - 23, Group C - 23, Group D - 23, Group E - 23.

Results

The analysis of data was accomplished by an analysis of covariance procedure using scores of the pre- and post-achievement test as covariant and criterion in one type of analysis, and pretest achievement scores and total examination points for the Winter Quarter as covariant and criterion in another type of analysis.

In all of the analyses[2] scores on the 230 item test of relevant psychological knowledge given at the beginning of the Fall Quarter were used as covariants. The

[2]Tables have been deposited with the American Documentation Institute. Order Document No. 8594, remitting $1.25 for 35 mm. microfilm or $1.25 for 6 by 8 in. photocopies. Advance payment is required. Make checks or money orders payable to: Chief, Photoduplication Service, Library of Congress.

criteria for achievement, or changes in performance, were either the scores on the 230 item test given at the end of the course or the total number of examination points obtained during the Winter Quarter from the three examinations given during that quarter. Winter Quarter examination points were used because an analysis of Fall Quarter examination points indicated no significant differences between conditions. In addition the machine groups were not able to start their experimental trials until two weeks after the beginning of the Fall Quarter, and it was felt that the cumulative effects of changes in achievement would be more pronounced during the Winter Quarter.

No significant differences were obtained, using the posttest achievement scores and the examination points as criteria, in a comparison of all five groups; although evidence of a trend in mean scores favoring the experimental groups did appear. Differences were obtained, however, at greatly beyond the .01 level of significance in comparing pre- and posttest scores for the class as a whole.

Since no attempt was made to control the use of the programed text by experimental groups A and C, other than to impress on the students the necessity and importance of using them for purposes of the experiment, an assessment of their use was made at the end of the course. A majority of students in group A indicated that they used the Hollard-Skinner programed text infrequently, while a majority of students in group C indicated a use of the Teevan-Jandron programed material most of the time. For this reason, an analysis was made combining group A with experimental group E and testing for differences between four groups instead of five. No significant differences were obtained, although the data did indicate a trend in means in favor of the experimental groups.

Because of this trend, it was decided to treat the experimental groups B, C, and D as one group, and to compare this larger experimental group to the already combined groups A and E which made up the control group for the comparison. The increase in the number of subjects in the groups was thought to offer a better basis of ascertaining significant differences between means where trends were already evident. These two groups did differ significantly (at between the .05 and .01 level of confidence) in the analysis of pre- and posttest scores on the 230 item test of relevant psychological knowledge, and they differed significantly (at between the .05 and .01 level of confidence) in the analysis of pretest and total Winter Quarter examination points.

Discussion

In discussing the results it might not be out of order to indicate that the gains in scores between the pre- and posttest of relevant psychological information does demonstrate that it is possible to teach the content of the Hilgard text in an introductory course in psychology. At the risk of doing the authors an injustice it also seems possible to infer that the students were not attracted by the Holland-Skinner text, remembering that when it was put on a tape for machine use and students were required to schedule appointments, it seemed to have more attention value.

In general, our results resemble those of other "shotgun" type experiments in the classroom in which the significant variables are difficult to define and are obscured by the small size of samples used. At the risk of proceeding with only minimal justification, the experimenters would like to offer their explanation of the difference

that does appear when the three effective experimental conditions are treated as one and the control condition is combined with the ineffective experimental condition (the non-use by the students of the Holland and Skinner text), although there are no differences between the four experimental conditions themselves. Following Underwood (1959) we would suggest that the single most important variable in learning is *the time spent in learning* and that the outstanding difference between our effective experimental conditions and the control conditions was that the experimental conditions assured an added time involvement by the students in the learning process. The implications of this for education are obvious.

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THE EFFECT OF IMMEDIATE AND DELAYED FEEDBACK ON RETENTION OF SUBJECT MATTER[1]

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Studies reporting the superiority of immediate knowledge of results over delayed feedback have appeared with some regularity during the past sixty years (Ammons, 1956; Landsman, 1962). Most of the research on knowledge of results has been concerned with non-meaningful verbal materials or motor skills. In the last few years, studies (Brackbill, Bravos, & Starr, 1962; Brackbill, Isaacs, & Smelkinson, 1962; Brackbill & Kappy, 1962; Brackbill, Wagner, & Wilson, 1964) have been reported which throw some doubt upon the universality of the principle of immediate knowledge of results when one considers the type of learning and the different organisms involved. Inferences based on studies of motor tasks do not necessarily yield information about verbal tasks, especially when the verbal tasks are meaningful.

The investigators during the past two years have participated in research projects studying the effectiveness of adjunct auto-instruction providing immediate knowledge of results (Cooperative Research Project No. 2306). Discussions of the research staff during this period raised the issue of whether immediate knowledge of results is necessary for the learning of meaningful verbal materials. The present study compares immediate knowledge of results with feedback delays of one hour, two days, and one week.

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